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ABSTRACT

The technology, symbol systems, and processing capabilities of a medium interact to provide unique opportunities for information access. This exploratory study examines the way that learners process videotaped materials on a familiar or unfamiliar topic as informed by text-based research. A variation of the think-aloud method of assessing cognitive processes was used to gain insight into the role of prior knowledge in learners' thoughts while viewing a videotape on the topic of instructional design. The nine participants in this study were enrolled in a graduate class in video production at a large midwestern university; participants were classified as either experienced in instructional design or unfamiliar with the topic based on prior exposure. The data from the think-aloud protocols suggest that all participants were attempting to relate the new information presented via videotape to topics with which they were familiar; in addition, all of those unfamiliar with the topic and half of those with experience in instructional design were frequently evaluating the production of the videotape while viewing the program. Analysis of the teach-back protocols provided additional information on the cognitive processing of the videotaped information. Participants with experience in instructional design included a greater percentage of inferences which linked the content of the videotape with other related ideas; participants unfamiliar with the topic included a greater percentage of comments that elaborated on the content of the tape. The results of this investigation provide evidence that the think-aloud and teach-back methods can be used successfully to gain insight into the cognitive processing of videotaped materials. (Contains 8 references.) (AEF)

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Information Processing Strategies Used in Learning from Video

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Information Processing Strategies Used in Learning from Video

Research on the manner in which learners process text materials has allowed the development of a rather comprehensive theory of text processing; however, there is less information available on how learners process information presented through television or videotape (1).

Videotape differs from text in several ways. Kozma (1) distinguished among various type of media in terms of their symbol systems, processing capabilities, and technology. The technology of text and videotape affect learning only to the extent that access to information present on videotape is limited to locations where a videotape playback machine and monitor are present, whereas access to text is much less restricted by location. However, the symbol systems and processing capabilities of the two media may affect the nature of the information gained and the way the information is processed. Text presents verbal information through printed words and uses pictures, diagrams and other representational symbol systems to present visual information. With videotape, the verbal information primarily is presented orally. Pictures and other representational images often depict motion and are usually presented simultaneously with the verbal information. Text allows the reader to access the information at random, but videotapes present information in a constant stream of auditory sounds and visual motion. Videotapes present information in a linear format, progressing without pause between the beginning and end of the program.

The technology, symbol systems, and processing capabilities of a medium interact to provide unique opportunities for information access. For example, I may be able to view a videotape demonstrating how to change a tire on a car in my home prior to attempting the task. The videotaped demonstration would allow me to see the specific items and procedures referred to by the verbal information. As such, I may be able to better "understand" the specific steps involved in changing a tire. I can see the results of improper actions at various stages in the process. However, due to the nature of the technology, I can not take the videotape with me to the location where I want to change a tire. With text-based information on the same topic, I am able to use the materials as a reference source while performing the task of changing my tire. The symbol system are limited to the printed word and still pictures, and I am not able to see the steps performed by another person. However, due to the random access provided by text, I am able to quickly locate references to specific steps where I may need additional information.

Role of Prior Knowledge

These differences in the processing capabilities of text and video may be especially acute for learners with prior knowledge of the content. Perhaps users have changed tires on other automobiles. They may be familiar with the steps of removing the hub cap, removing the lug nuts, and so forth, but may have never used the particular type of jack that came with their cars. With text-based materials, they can quickly skip over the steps on which they need no more information and go rather directly to the information needed. Videotape does not provide such easy random access to specific information.

Given the differences in the ease with which learners may randomly access text and video-based information, it may be useful to look at how these capabilities are used by learners reading text. Bazerman (2) found that experts in the domain of physics searched the literature for new information to update their knowledge in a random manner, driven by "purpose laden schemata". The physics experts skimmed articles in their content area very quickly and randomly. Often they began reading the abstract or conclusion, and once they determined that the article was of personal value, they often skipped to certain sections. Their access to information was guided by their search for very specific information to complement their existing knowledge. They appeared to be seeking answers to very specific questions, seeking information that fit within their existing schemata of physics and the way research should be done. It is unlikely that novices would have been able to read articles reporting physics research in a similar way. Instead, it is likely that they would have needed to start at the beginning and carefully construct a mental model of the content in order to understand the message of the article.

It is obvious that text can be explored differently based on the prior knowledge that users bring to the reading task. Due to its stability, the reader has "random assess" to the information on the printed page. Although text information is primarily designed to be read in a linear sequence, the stability of text allows

the users to access the information in a sequence of their own choosing. Yet even when reading in a linear sequence, the learners' prior knowledge may affect the way they process the information

Steinley (3) compared the processing styles of readers as they read passages on word games with which they were familiar (crossword puzzles) and unfamiliar (doublets). He asked them to compare crossword puzzles and doublets with word search games (with which they were familiar). Readers were instructed to pause at the end of each paragraph and note whether they were attempting to "comprehend" the information or "compare and contrast" the information with word search games. As predicted, readers spent more time comparing and contrasting crossword puzzles with word search games than in comparing and contrasting the unfamiliar game of doublets with word search games. Conversely, the researchers found that readers spent significantly more of their time trying to comprehend passages on the word game unfamiliar to them than on the word game familiar to them. As readers concentrated on comprehending unfamiliar topics, they based their selection of a comprehension strategy on limited background knowledge, the complexity of the game, or their lack of information necessary to compare or contrast the game with a more familiar game. When reading about the familiar topic of crossword puzzles, readers also indicated the use of a comprehension strategy fairly often, but provided much different reasons for doing so. When reading text on the familiar topic, they selected a comprehension strategy to attend to details, to orient themselves to the text passage, and when nothing in the paragraph was useful for comparisons.

Consistent with mental model theory, these findings suggests that learners build a mental model of new content from the bottom-up, while they process information on a familiar topic in a top-down manner, calling upon existing knowledge and modifying it as they attend to relevant new information (4). Whereas novices' knowledge is limited and organized around the explicit information presented, experts reorganize new information around principles and abstractions of their prior knowledge on the subject (5). The studies cited above suggest that learners with prior knowledge of a text topic may choose to access the information randomly or engage in actively comparing new information with their prior knowledge. However, due to the transient nature of information presented through videotape and the linear nature of the medium, learners may be unable to process video-based instruction in the same manner as they process text-based instruction.

Purpose of the Study

The purpose of this exploratory study was to examine the way that learners process videotaped materials on a familiar or unfamiliar topic as informed by text-based research. A variation of the think-aloud method of assessing cognitive processes was used to gain insight into the role of prior knowledge in learners' thoughts while viewing a videotape on the topic of instructional design. Sasse (6) suggested that a teach-back technique, where learners are asked to "teach" a subject to a new learner, may be an effective way to determine learners' mental models of a content area; thus, the teach-back method, in combination with think-aloud protocols, was used to assess the manner in which the content was incorporated with the learners' prior knowledge. It was expected that learners with prior knowledge of instructional design would make more comments that compared and contrasted the new information with their prior knowledge than those unfamiliar with the topic of the videotape.

Methods

Participants

The nine participants in this study were enrolled in a graduate class in video production at a large midwestern university. Participants were classified as experienced in instructional design or unfamiliar with the topic based on prior exposure to the topic of instructional design in coursework or practice. Students were asked whether they a) had ever taken a course in instructional design, b) had designed instructional materials, and c) were familiar with any instructional design models. Five students responded positively to at least one of these three questions, and four responded negatively. One student experienced in instructional design was dropped from the analysis due to technical problems in recording her responses, thus, the final sample consisted of four experienced participants and four participants unfamiliar with the topic.

Materials

The videotape used in this study described the development of a course using a model of instructional design unique to a particular organization. Although the steps in the design process are similar to those in the model(s) with which some of the participants were familiar, the steps were clustered differently and the tape used different terminology. None of the participants were familiar with the particular model of design presented in the videotape. The videotape provided a general overview of the

components of the instructional design process and the people involved. The program then presented the details of each of the five stages in the instructional design model in sequence. The tape described the steps involved in each stage of design and the roles of the individuals involved in completing the steps. For the purposes of this research, the videotape was divided into six segments ranging in length from 1.5 to 4 minutes.

Data Collection

Think-aloud protocols have been used to examine the cognitive processing of experts and novices in problem solving tasks (7) and in research on learners' mental models (6). Thus we believed that the think-aloud method would allow us to determine the extent to which viewers of a videotape on a familiar or unfamiliar topic were attempting to comprehend new information in order to construct a mental model of the topic or compare and contrast the new information with their prior mental models. However, when processing text materials, readers are able to pause in their reading to orally express their ideas. Due to the continual pace of auditory and visual information presented via videotape, verbalizations during viewing are likely to interfere with attending to information at the pace at which it is presented. Although viewers could pause the videotape to verbalize their ideas, we felt the freedom to pause the videotape to "think-aloud" about it's content would provide viewer control of the pace of information presentation and represent an artificial manipulation of the typical videotaped or televised presentation. Thus, in this study, the viewers were asked to "think-aloud" at the end of each of the six subsections in the videotape.

At the end of each subsection (ranging in length from 1.5 to 4 minutes), the interviewer stopped the videotape and asked the participant to verbalize his or her thoughts during the previous section. The first section, which provided a general introduction to the instructional design model and personnel, was used for the participants to practice the think-aloud method. The think-aloud data consists of the verbalizations which followed the five remaining sections, corresponding to the five stages in the design model. The verbal data were audiotaped, coded by participant number, and transcribed for analysis.

A teach-back technique was used to assess the learners' understanding of the tape's content. At the end of the videotape, the participants were asked to "teach" the instructional design process, as presented in the videotape, to the interviewer. The verbal responses to the teach-back task were audiotaped, coded by participant number, and transcribed for analysis.

Procedures

Each participant met with the interviewer individually in a quiet room. All interactions were audiotaped. When the participant arrived, he or she was greeted by the interviewer, questioned on prior experience with instructional design and with this particular design model, and informed of the topic of the videotape and the task for the experimental session. They were told that, at the end of the program, they would be asked to teach the method of instructional design described in the videotape to the interviewer and informed that they could take written notes if desired. Participants were instructed in the think-aloud method. They were told that the interviewer would stop the videotape from time to time, and, at that time, they were to orally recall their thoughts during the previous section of the tape.

As the participants watched the videotape, the interviewer stopped the videotape at the end of each of the six sections and the participants orally reflected back on their thoughts during the previous section. The first section of the videotape was used to "practice" the think-back method, thus, no data was collected from this section. At the end of the videotape, the viewer was asked to describe any thoughts he or she had on the program as a whole, then asked to describe the model presented in the videotape as if he or she was teaching it to a classmate.

Data Analysis, Results, and Discussion

The think-aloud data and teach-back data were analyzed to determine differences between those familiar and unfamiliar with the topic. It should be noted that this was an exploratory study, thus no hypotheses were formally tested. Initially, overall frequencies and percentage scores of coded categories were tabulated for the think-aloud and teach-back data. Finally, the think-aloud and teach-back protocols were analyzed qualitatively to complement and inform the patterns discerned in the quantitative data.

Think-alouds

The coding of the think-alouds protocols followed the recommendations of Ericsson and Simon (7). The verbatim transcriptions of the think-aloud data were divided into statements representing complete thoughts. The statements from each participant were coded as to participant number then jumbled so that

the interpretation of one idea was not influenced by the participant's prior statements. In order to develop coding categories, one researcher read the entire list of statements and looked for themes to emerge from the participants' verbalizations. She identified a set of seven coding categories. Statements seemed to refer to 1) the viewers' comprehension of the material, 2) positive evaluations of their comprehension, 3) negative evaluations of their comprehension, 4) the instructional design process, 5) the quality of the video, 6) distractive aspects of the video, and 7) other miscellaneous comments. Using this set of coding categories, two other researchers independently coded the statements into these categories. Both researchers then sorted the statements by coding category and examined the lists to determine if all of the statements coded into a particular category were of a similar nature. Following this self-check procedure, the two researchers compared their coding of each statement. Differences in coding were discussed until the researchers came to agreement. The majority of coding differences occurred due to the difficulty that the coders had in discriminating between statements belonging in the two categories of "distracted by visuals" and "quality of video". Due to difficulties in definitively placing certain statements into one of the two categories ("distracted by visuals" and "quality of video") , they were collapsed into one ("quality of video"). Definitions of the coding categories and example statements are presented in Figure 1:

Figure 1: Coding Categories for Think-aloud Protocol

Comprehension	statements reflect an attempt to comprehend the content of the program: *"They went over objectives, content, topic activities, scripts, budget, and then the design"*
Positive evaluations of comprehension	statements are positive affirmations of one's comprehension: *"It makes pretty good sense."*
Negative evaluations of comprehension	statements are negative comments on one's comprehension: *"It's confusing."*
Design	statements compare or contrast the information with prior knowledge of instructional design: *"They follow the instructional design process that I'm familiar with."*
Quality of video	statements comment on the quality of the visuals or audio: *"I thought they could have been a little more creative".* Some statements indicate the viewer was distracted by the visuals or audio: *"I was spending a lot of time looking at where people were in their office and where they were going next."*
Other	statements compare or contrast the information with other prior knowledge: *" Part of it I related to a class I'm taking right now where we're talking about reliability and validity."*

Following the coding of each statement, the percentage of statements falling in each category was calculated by group (experienced in instructional design and unfamiliar with the topic). As you will notice from Table 1, the mean percent of comments were very similar between the two groups in a number of coding categories. Participants who were experienced in instructional design (E) and those unfamiliar with the topic (U) had a similar percent of comments relating new information to their prior knowledge of design, relating new information to other prior knowledge, and negative evaluations of their comprehension. Those experienced in instructional design had a greater percentage of comments that positively evaluated their comprehension. There were greater differences in the percent of comments made

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in two other categories: Participants unfamiliar with the content made a greater percent of comments related to the quality of the video than those experienced in instructional design; however, experienced participants made a greater percent of comments indicating comprehension of the content than those who were unfamiliar with the topic of the videotape.

Table 1: Think-aloud task: between group percentages and standard deviations

Coded category	QV	C	D	N	P	O
Experienced						
X%	22.1	41	15	13	7	2
(SD)	(2.6)	(11)	(3)	(3)	(1)	(1)
Unfamiliar						
X%	53.4	15	14	12	1	4
(SD)	(5.8)	(0.5)	(3)	(3)	(1)	(1)

Note: QV: Quality of video
C: Comprehension
D: Design process
N: Negative evaluations of comprehension
P: Positive evaluations of comprehension
O: Other statements

The similarities between the two groups in the percentage of comments comparing or contrasting the information in the tape with prior knowledge of design was surprising and prompted a review of the individual think-aloud protocols. Although the participants classified as unfamiliar with the topic of instructional design indicated that they had never had a course in the topic, had never designed instructional materials, and were not familiar with any instructional design models, their comments during the think-aloud protocols indicated that they were interpreting the content of the videotape relative to knowledge gained through other courses and work experience. The following comments from the protocols of those unfamiliar with the process of instructional design illustrate how they were attempting to relate the content of the videotape to their prior knowledge:

It's sort of the pattern we have learned in EDCI class, talking about the same things... whether it's feasible or not, the objectives, the outline, and that kind of stuff. So it's just like all those things that I already learned in that class.

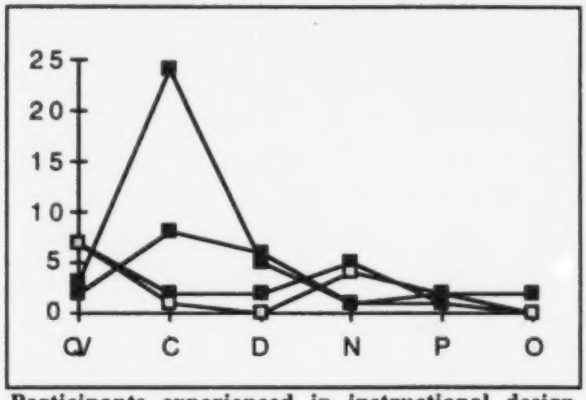
Like I said before, it's like may EDCI class. It's pretty much the same things that we're doing in our project. And I realized that I was thinking that right now we're about;to do the same things they're talking bout in our class projects.

Well, again, that's getting to some material I already covered, but what I was thinking about was that I'm doing a project for one of my courses right now, developing instruction for a problem I have a t work and I was thinking when they were giving different drafts and so forth that this material... I guess.... and I guess I was thinking a lot of time looking at where people were in their office and where they were going next... and again, that could be because I've had this material before...

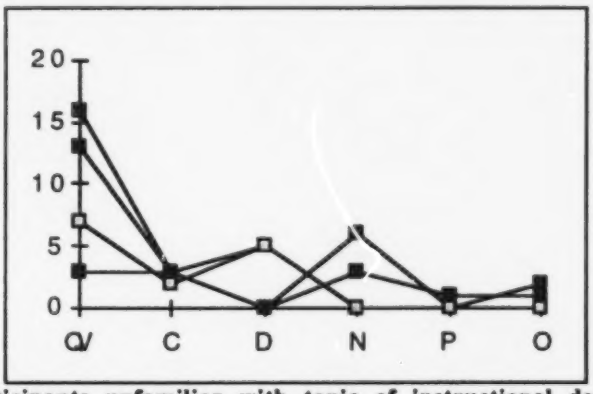
From these comments, it appears that the participants who indicated that they were unfamiliar with instructional design began to see the similarity between information they had been exposed to in other classes and the process of instructional design. It must be noted that all of the participants were involved in the pre-production planning stages of videotape production. Although they may have been unfamiliar with the term "instructional design", they began to see that they were familiar with some aspects of the process.

Within group variation, as indicated by the wide standard deviations in some categories, also prompted a closer examination of individual protocols. (see Figure 2).

Figure 2: Think aloud frequencies by group



Participants experienced in instructional design



Participants unfamiliar with topic of instructional design

Note: QV: Quality of video
C: Comprehension
D: Design process
N: Negative evaluations of comprehension
P: Positive evaluations of comprehension
O: Other statements

One designer had a large number of additional comments related to comprehension of the program. When examining his comments coded as "comprehension" in the context of adjacent comments, the vast majority of them were related to trying to understand how he would teach the material:

> *I was trying to get it down so I could reteach it. I was trying to get as much of it down as I could. I understand it. I understand it from what I've done, so I was mainly just focusing on getting the main points down.*
>
> *I was still trying to get all the parts down. All the different pieces of the puzzle, because it makes sense. It fits with what I already know.*
>
> *Generally, I was just trying to get it down and think about how I would present it.*

As this individual was a teacher and was told that he would be expected to teach the instructional design model to the interviewer after viewing the tape, it was not surprising that he was concentrating on comprehending the information in ways that would facilitate the teaching of the content.

In rereading the entire protocols for each individual, two of the experienced designers seemed very distracted by elements related to the design of the video:

There's a lot of audio.. just with all he's talking about... and he's going from scent to scene...

Between those particular segments, I guess there was a lot of music. I tried to tune it out...."

The whole time I was thinking this video could be seven or eight different videos... different one-hour videos..."

When he was writing on the chalkboard... it was driving me nuts... I thought he should have had an overhead or something...

All of those unfamiliar with the content of the videotape focused the majority of their comments on the quality of the videotape (two individuals in particular), as indicated in the following comments:

I actually lost track of him at one time.. I was looking at the light on the bald guy's head, thinking that they should have done the lighting different.."

I actually didn't hear the first thing he was saying because I was thinking about the previous section, if those people were actors or the actual people like the writer, etc. and that's about all I was thinking about in that segment.

I felt that there would have been a better way to do this, like with graphics and bullets or something... of course, this could be because of the course I'm taking in my video class... I think that putting things on the board took too much time, and I found myself watching him spell instead of listening...

It appears that all participants were attempting to make sense of the content of the videotape relative to their prior knowledge. Those experienced in instructional design had the background necessary to "comprehend" the content of the tape. However, rather than focusing on the process of instructional design described in the tape, those unfamiliar with the process concentrated on evaluating the production values of the videotape. Although all the participants were enrolled in a course on videotape production and each participant possessed a similar awareness of good production techniques, those unfamiliar with the topic of instructional design may have been unable to build a coherent mental model of instructional design; thus, they may have reverted to interpreting the videotape based on their mental models of good video production techniques.

Teach-backs

Using a procedure described by Pask and Scott (8), the audiotaped teach-back protocols were transcribed and the statements were coded into categories used by Pask and Scott. Unlike the analysis of the think-aloud protocols which were coded as independent thoughts, the coding of the teach-back statements required an awareness of ideas that came before and after the statement to be coded.

Initially, statements were coded using Pask and Scott's categories (8); however, the need to modify the categories to encompass the data set soon became apparent. The final coding categories were determined though a review of the teach-back protocols to determine categories of responses. Two researchers, unaware of the group to which the participants belonged, independently read the protocols to determine trends in the data. Both researchers identified similar trends in the data, and coding categories were finalized. This analysis resulted in the elimination of certain categories used by Pask and Scott (8) and the subdividing of others. Both researchers then coded the teach-back protocols independently. Then, the two researchers compared their coding of each statement. Differences in coding were discussed until the researchers came to agreement. Definitions of the coding categories used in the final analysis and example statements are presented in Figure 3:

Figure 3: Coding Scheme for Teachbacks

Advance organizers	preview information to come: *"I can tell you of the overall design process from [lists steps]".*
Reviews or summaries	review or summarize previously presented information: *"Once you've established your objectives.."*
People	mentioned people from the videotape: *"there is the director for the program part of it.."*
Steps	mention steps in the instructional design process *"you're assessing your training needs."*
Other	recall other information directly from the tape (other than steps in the process or the people involved): *"... costs quite a bit of money and time".*
Elaborations	provide additional information on the people, steps, or other information derived from the tape: *"...they're the ones who actually do the testing"*
Inferences	derived from information stated in the tape or from prior knowledge: *"I call that the subject matter expert".*

Table 2: Teachback task: between group percentages and standard deviations

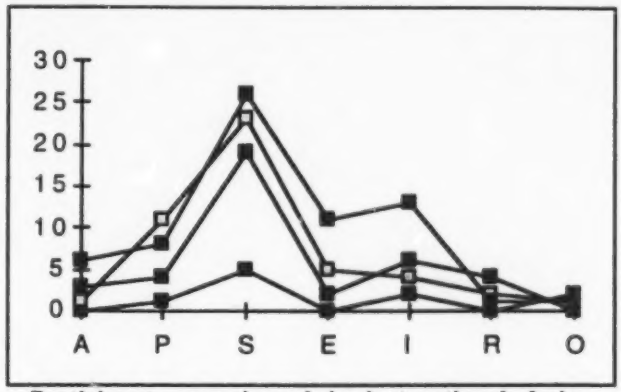
Coded category	A	P	S	E	I	R	O
Experienced							
X%	6.2	15	45	11	16	4	2.5
(SD)	(2.6)	(4.4)	(9)	(5)	(5)	(2)	(.08)
Unfamiliar							
X%	5.5	15	43	23	7	4	1.6
(SD)	(2.1)	(3.8)	(6)	(8)	(1)	(2)	(1)

Note: A: Advance organizers
P: People mentioned in tape
S: Step in design process
E: Elaborations
I: Inferences .
R: Review or summary statements
O: Other information recalled

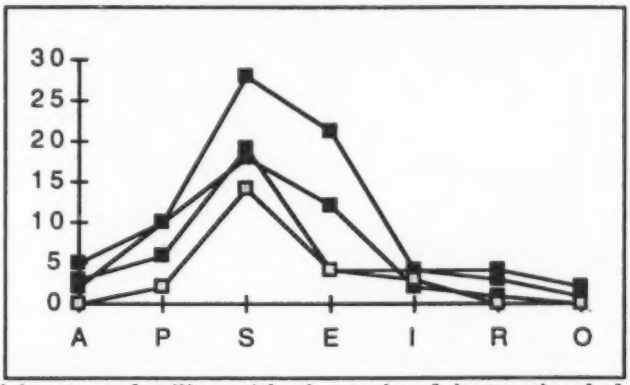
Following the coding of each statement, the percentage of statement falling in each category was calculated by group. As you will notice from Table 2, there was little difference in the percentage of comments coded as advance organizers , people mentioned , steps mentioned, review or summary statements, or other information recalled directly from the tape. However, participants who were unfamiliar with instructional design elaborated on the information recalled from the tape to a greater extent than those experienced in the process . Those experienced in instructional design expressed more inferences derived from the tape or prior knowledge than those unfamiliar with the process.

As indicated in Figure 4, there was less within group variation in the teach-back data. One individual in the group of experienced designers had fewer comments coded as "Steps" than the other three, and one participant unfamiliar with instructional design had more comments coded as "Steps" and "Elaborations" than the other three inexperienced participants.

Figure 4: Teach-back frequencies by group



Participants experienced in instructional design



Participants unfamiliar with the topic of instructional design

Note: A: Advance organizers
S: Step in design process
I: Inferences
O: Other information recalled
P: People mentioned in tape
E: Elaborations
R: Review or summary statements

In general, both groups mentioned a similar number of instructional design steps, people involved in the process, and other information stated in the tape. It must be noted that participants were encouraged to take notes to aid them in performing the teach-back task in order to replicate a natural setting in which an instructional videotape would be used. It is likely that the participants were guided by their notes when teaching the process back to the interviewer, thus, both groups recalled a similar number of steps, people, and other details from the tape. Both groups organized their teach-backs similarly, with both groups using a similar number of advanced organizers and review and summary statements.

However, when asked to teach the instructional design method to another person, there were differences in the way the two groups approached the task: those with experience in instructional design included a greater number of inferences derived from the tape or prior knowledge, while those unfamiliar with the process included a greater number of elaborations on the information recalled from the tape. Inferences reflected information not explicitly stated in the tape, but which could be derived from prior knowledge or by linking information in the tape in a new way. In the following examples, the segments coded as inferences could not have been derived from the content of the tape:

They call it the content person (coded as People). *I call that the subject matter expert* (coded as Inference)

....you actually do the production (coded as a Step) ... *This cost quite a bit of money here, too.* (coded as Inference).

The first area is to determine the feasibility (coded as a Step).... *I would imagine that's when you go into a needs analysis.* (coded as an Inference)

On the other hand, those unfamiliar with the process of instructional design included a greater number of elaborations in their teach-backs. Elaborations differed from inferences in that statements coded as elaborations expanded upon the information recalled from the tape. They offered additional details supporting the recall of steps, people, or other information presented in the tape. Consider the following segment from the teach-back protocols of inexperienced participants:

You're assessing your training needs- (coded as a Step)... *does it need to be done? I s the instructional design and development the right things to do based on the subject matter expert, background information.* (coded as an Elaboration)

Then it goes into development (coded as a Step) *where they go ahead and piece together everything, like it needs slides, video, music, anything like that they are going to need* (coded as Elaboration).

Then there's the design report (coded as a Step) *so that it actually includes the blueprint and just summarizes all these little aspects* (coded as Elaboration).

The analysis of the teach-back protocols suggests that experienced participants may have been able to built from prior experience to generate inferences during the teach-back sessions; however, participants unfamiliar with the topic of instructional design may have used the opportunity to teach-back the topic presented in the videotape to further process the information as they explained it to the interviewer through elaborating on the topics as they spoke.

Conclusion

Based on the research conducted with text, we expected that those familiar with the topic of the videotape would compare and contrast the new information with their prior knowledge as they viewed the videotape. We expected them to seek answers to questions that they had about the process of instructional design specific to this particular organization in order to modify their existing mental models of the topic. Conversely, we expected those unfamiliar with the topic to concentrate on comprehending the information in order to build a mental model of the content.

The data from the think-aloud protocols suggest that all participants were attempting to relate the new information presented via videotape to topics with which they were familiar. While those with experience in instructional design did compare the new information to their prior knowledge of the topic, those unfamiliar with the topic appeared to be relating the steps in the instructional design process to the steps in planning for a videotape production. Comments such as "this is like what we're doing in my education class " were common.

In addition, all of those unfamiliar with the topic and half of those with experience in instructional design were frequently evaluating the production of the videotape while viewing the program. As an exploratory study, this investigation was limited by the fact that all participants were enrolled in a course which offered them the knowledge needed to critically examine the production of the videotape. However, these statements provide further evidence that the viewers relied on knowledge gained in other contexts to interpret what they saw in the videotape.

Analysis of the teach-back protocols provided additional information on the cognitive processing of the videotaped information. Participants with experience in instructional design included a greater percentage of inferences which linked the content of the videotape with other related ideas; participants unfamiliar with the topic included a greater percentage of comments that elaborated on the content of the tape. The nature of the comments coded as inferences suggests that the experienced participants may have stored the new information with their prior knowledge of instructional design, and thus, as they recalled the information from the tape, they also recalled other related ideas. The nature of the comments coded as

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elaborations suggests that those unfamiliar with the topic of the videotape may have continued to process the content of the tape during the teach-back sessions, mentally organizing the information as they elaborated on the content and added details to the steps recalled from the tape.

As an exploratory study, the results of this investigation provide evidence that the think-aloud and teach-back methods can be used successfully to gain insight into the cognitive processing of videotaped materials. Prior to this study, no published studies reported using the think-aloud or teach-back method to collect data on viewers' cognitive processing. The think-aloud protocols seemed to reasonably represent the viewers' thoughts during the program. Future studies using similar procedures should collect student notes to complement the oral data. In addition, the teach-back method seemed to provide further information on the learners' cognitive processing of the information presented via videotape. Future research should continue to examine the relationship between learners' prior knowledge of the content of a videotaped presentation and the way they process the information presented though this linear, transient medium.

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